US010280588B2

(12) **United States Patent**
Calvert et al.

(10) **Patent No.: US 10,280,588 B2**
(45) **Date of Patent: May 7, 2019**

(54) **COUPLER FOR EARTH MOVING OR MATERIALS HANDLING MACHINE**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/862,387**

(22) Filed: **Jan. 4, 2018**

(65) **Prior Publication Data**

US 2018/0127947 A1 May 10, 2018

Related U.S. Application Data

(63) Continuation of application No. 12/598,018, filed as application No. PCT/NZ2009/000030 on Mar. 6, 2009, now Pat. No. 9,863,117.

(30) **Foreign Application Priority Data**

Mar. 7, 2008 (NZ) 566528

(51) **Int. Cl.**
E02F 3/36 (2006.01)

(52) **U.S. Cl.**
CPC ***E02F 3/3627*** (2013.01); ***E02F 3/364*** (2013.01); ***E02F 3/365*** (2013.01); ***E02F 3/3645*** (2013.01); ***E02F 3/3663*** (2013.01)

(58) **Field of Classification Search**
CPC E02F 3/36; E02F 3/3622; E02F 3/3627; E02F 3/3631; E02F 3/3663; E02F 3/3672;
(Continued)

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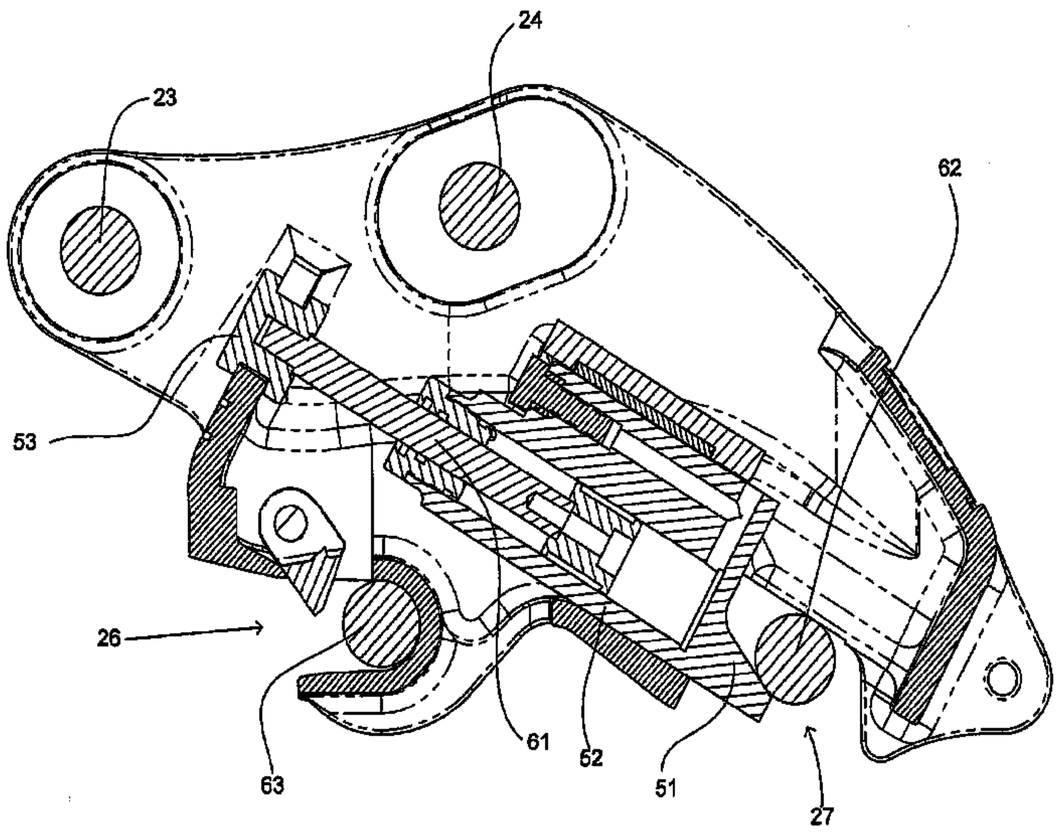
(57) **ABSTRACT**

A coupler is configured to couple an implement to an earth moving or materials handling machine. The coupler includes a locking member for locking a pin of an implement into a coupler in the recess. The locking member is driven by a hydraulic arrangement, with the hydraulic cylinder body being formed integrally with either the coupler body or the locking member. The coupler may be adapted to accommodate a range of implement pin spacings and/or diameters, so that the coupler can be used with different implements and in particular with different makes of implement.

9 Claims, 9 Drawing Sheets



(58) **Field of Classification Search**
CPC ... E02F 3/401; E02F 3/404; E02F 3/96; E02F 3/962; E02F 3/364; E02F 3/3645; B66F 9/12
USPC 414/723, 724
See application file for complete search history.

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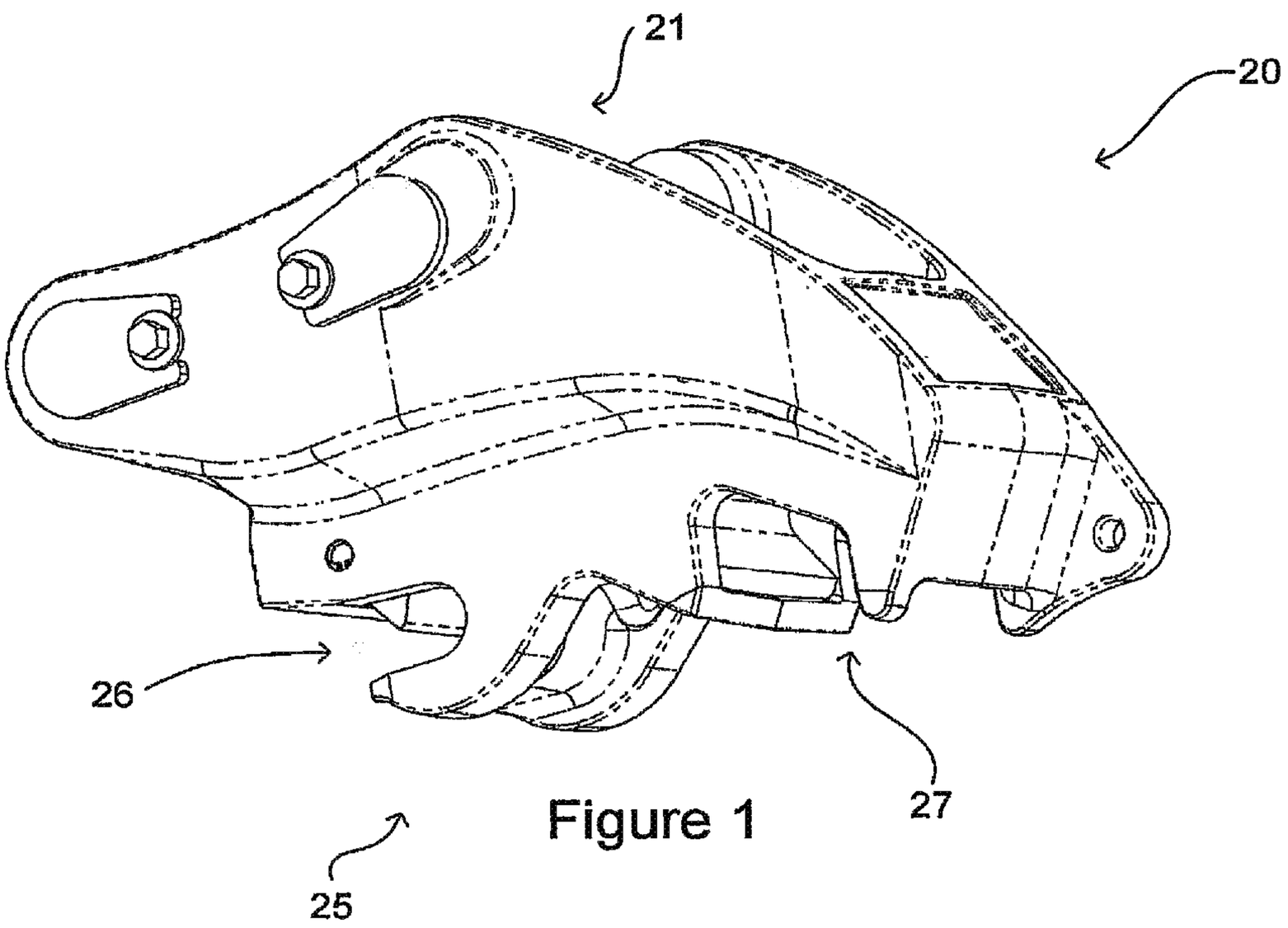

Figure 1

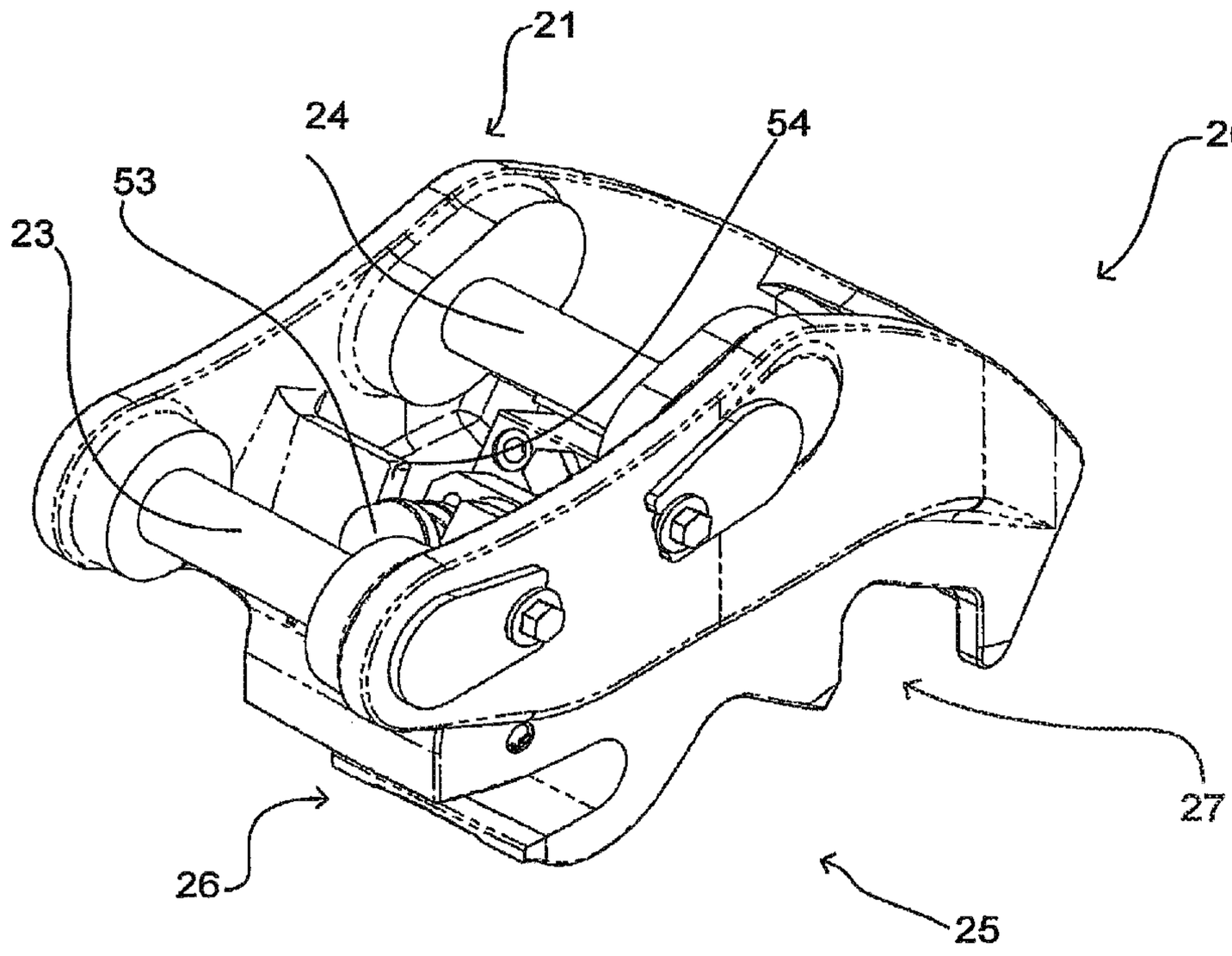

Figure 2

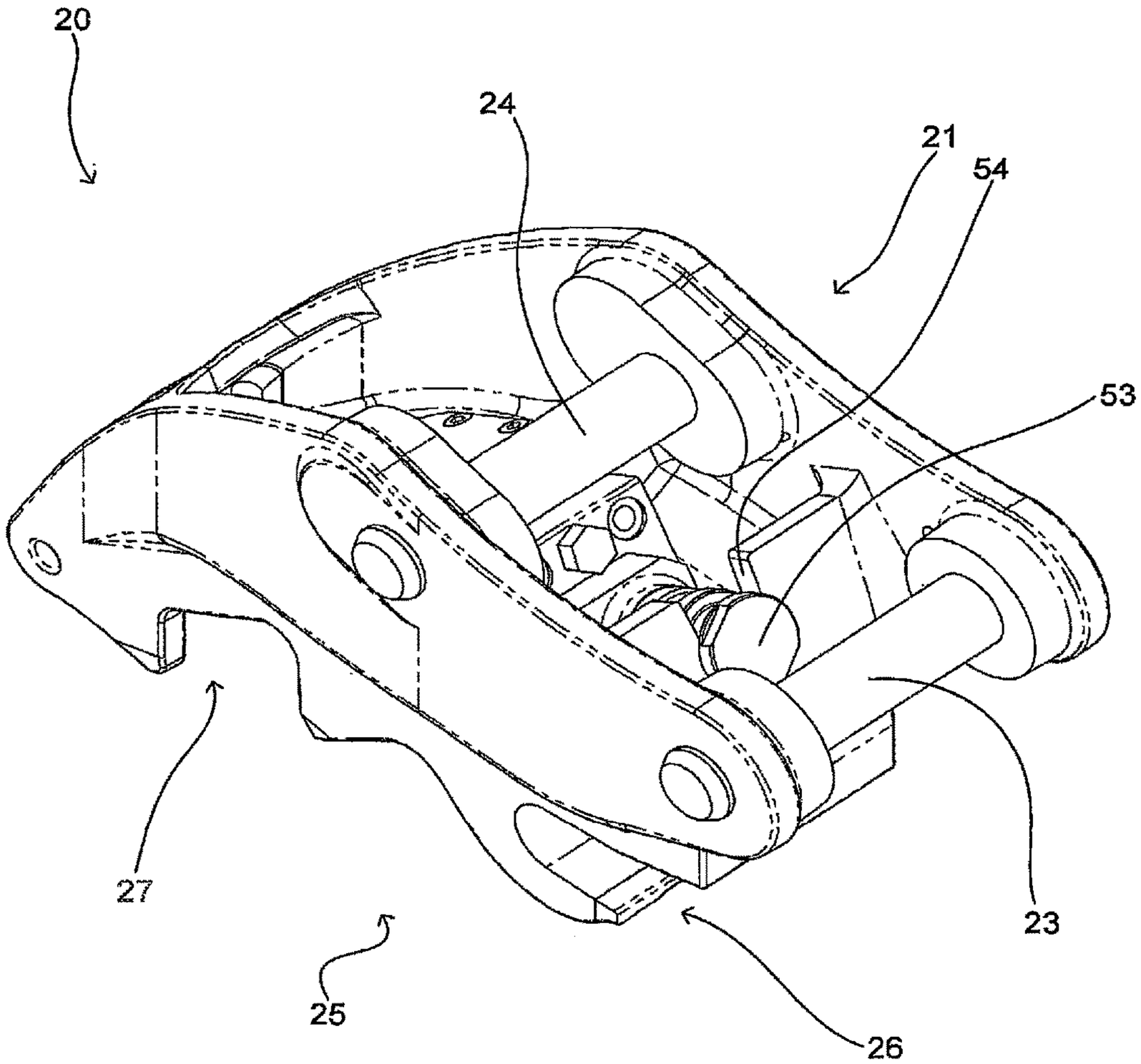

Figure 3

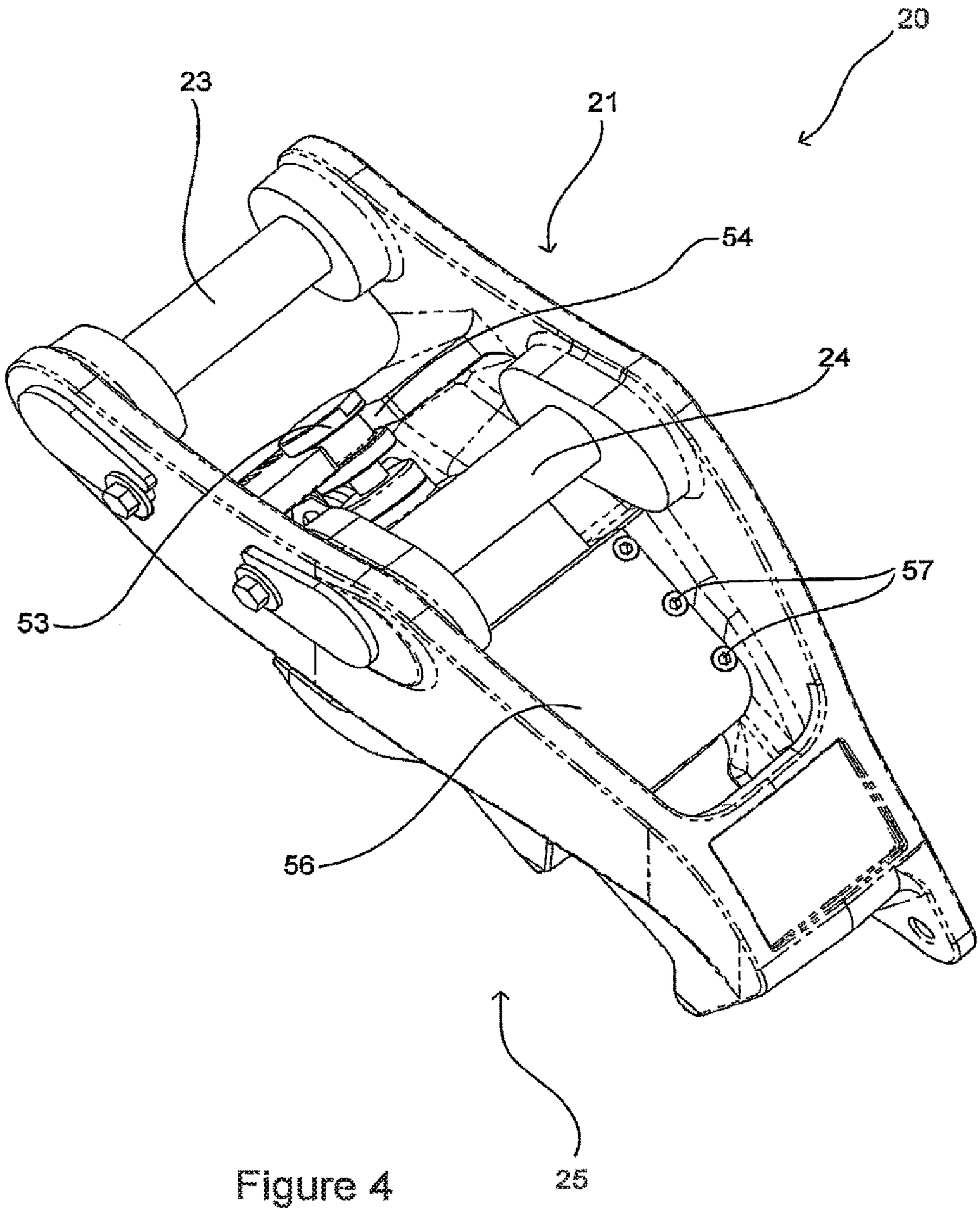

Figure 4

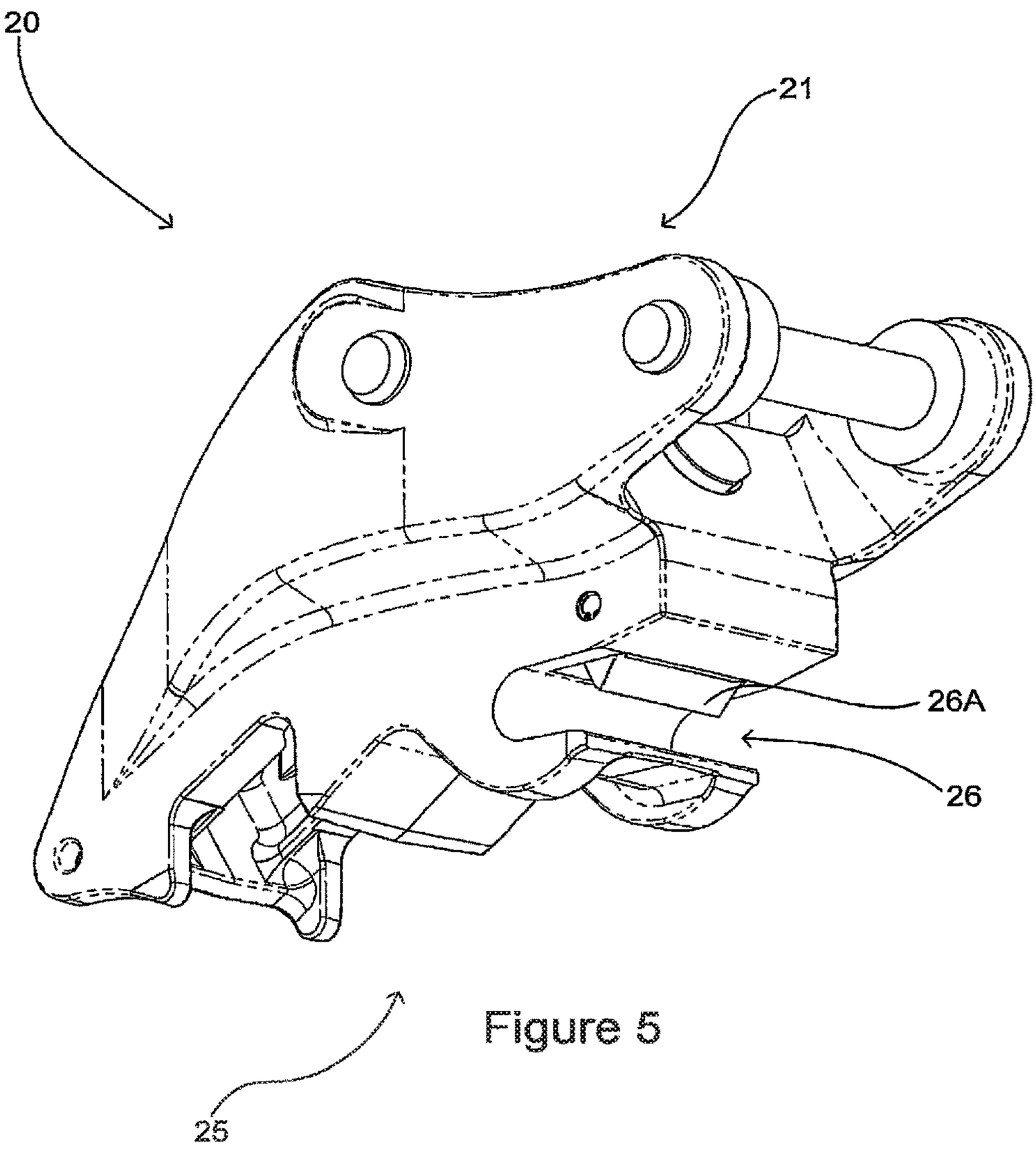

Figure 5

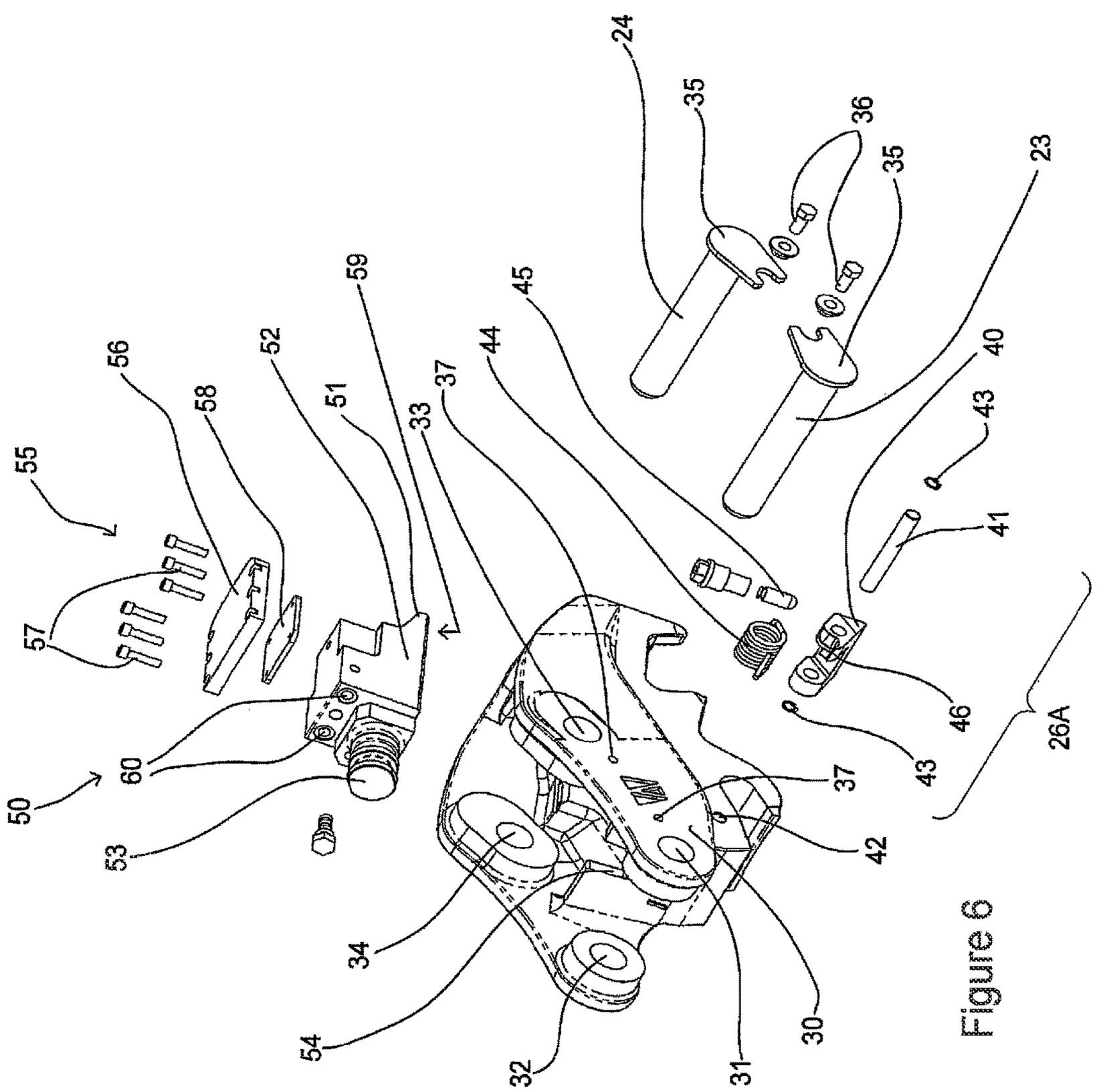
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Figure 6

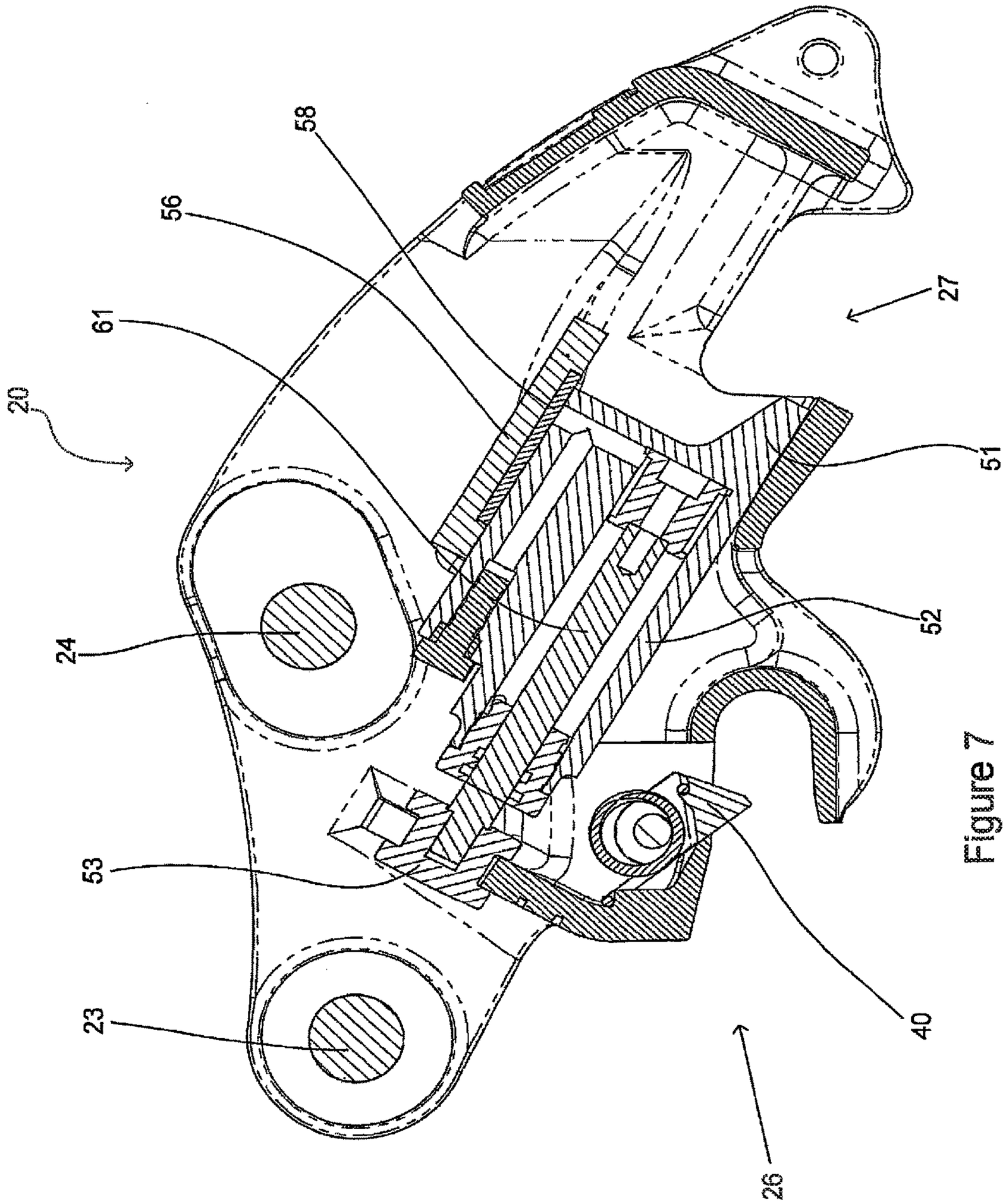

Figure 7

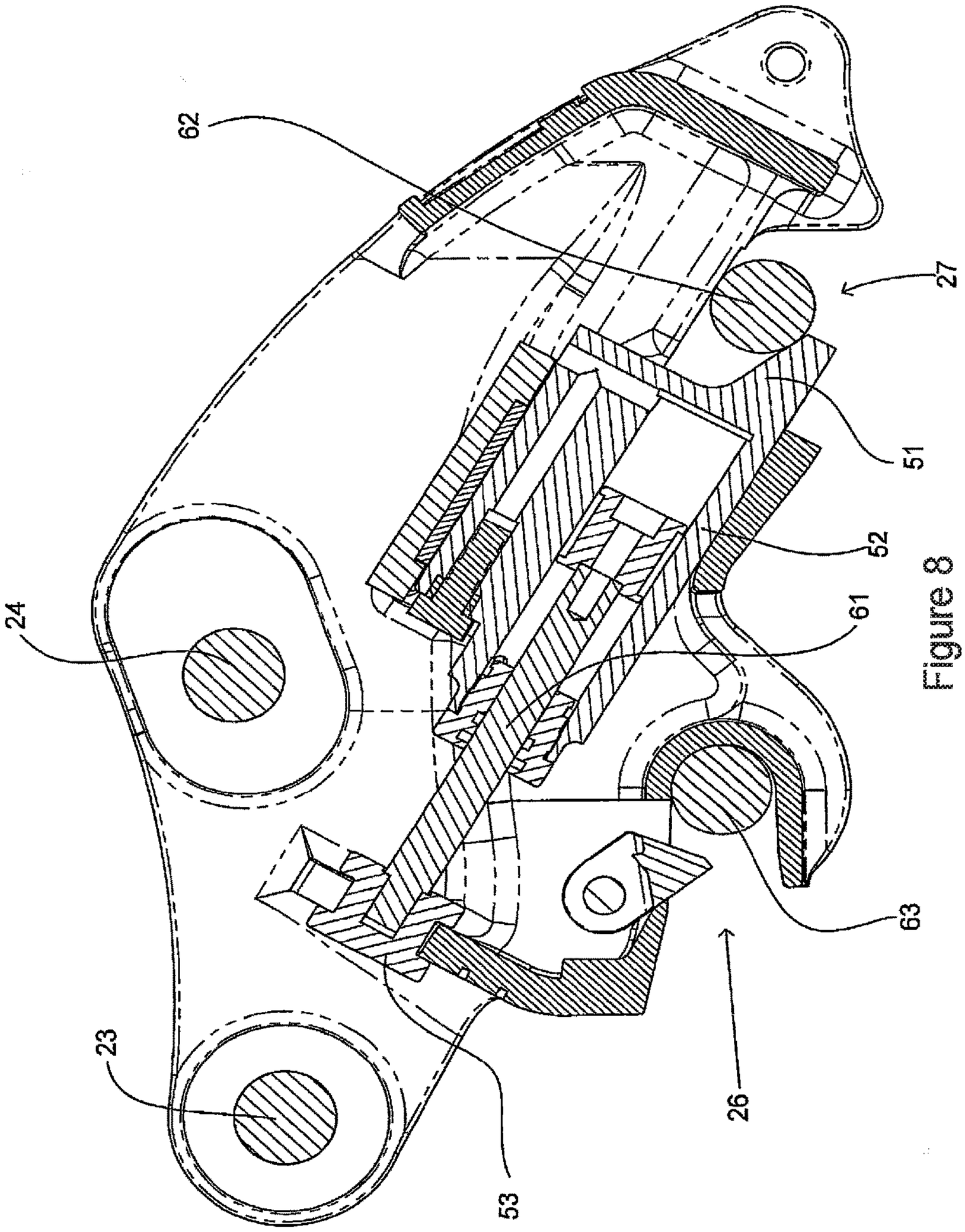

Figure 8

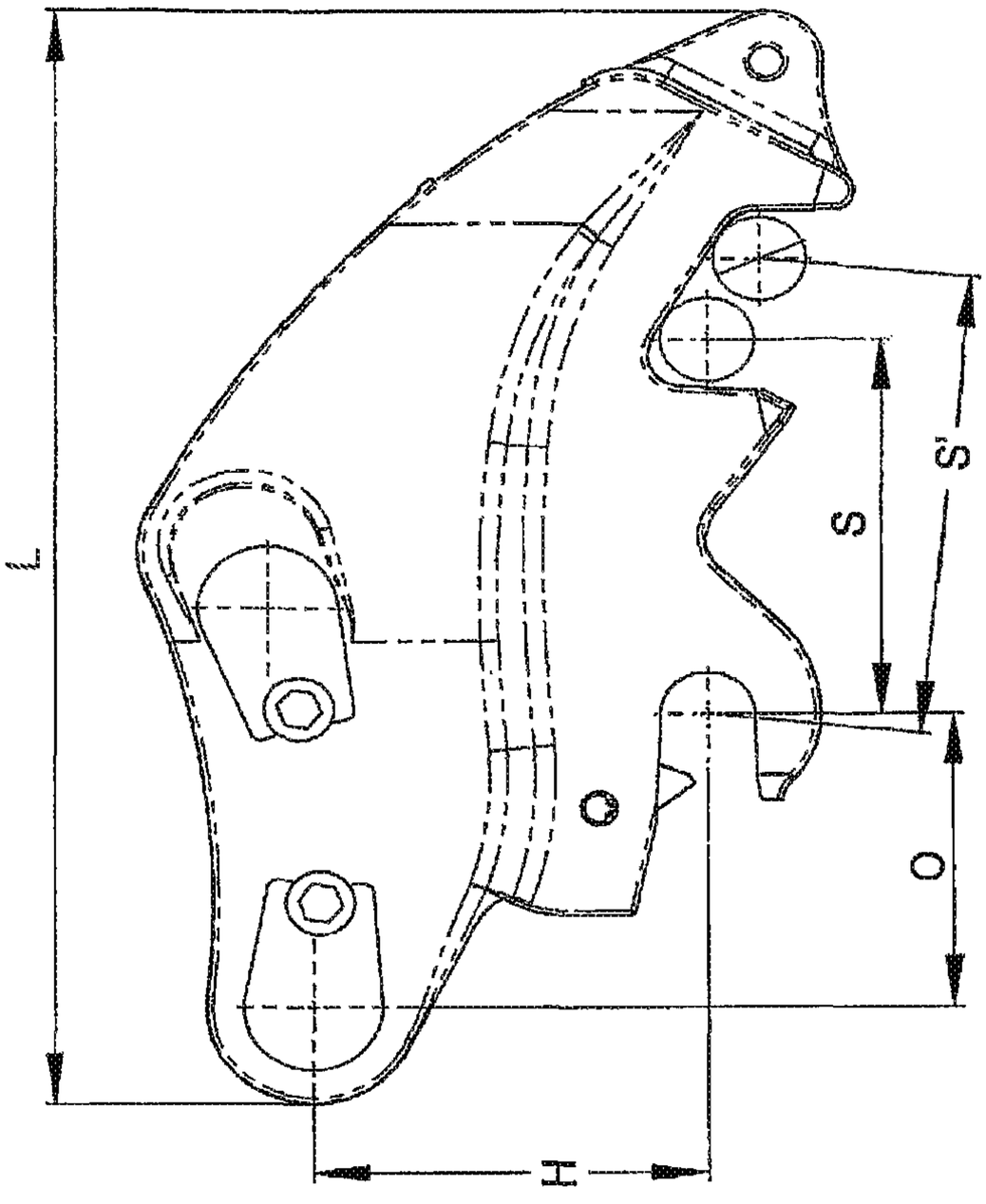

Figure 9

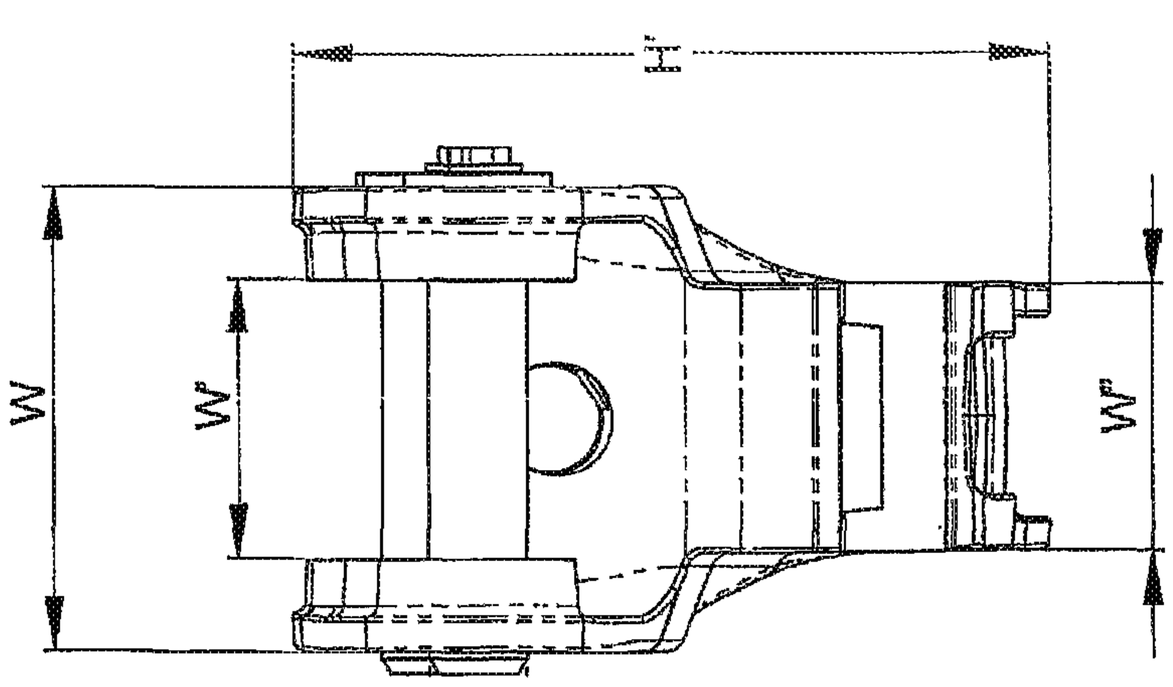

Figure 10

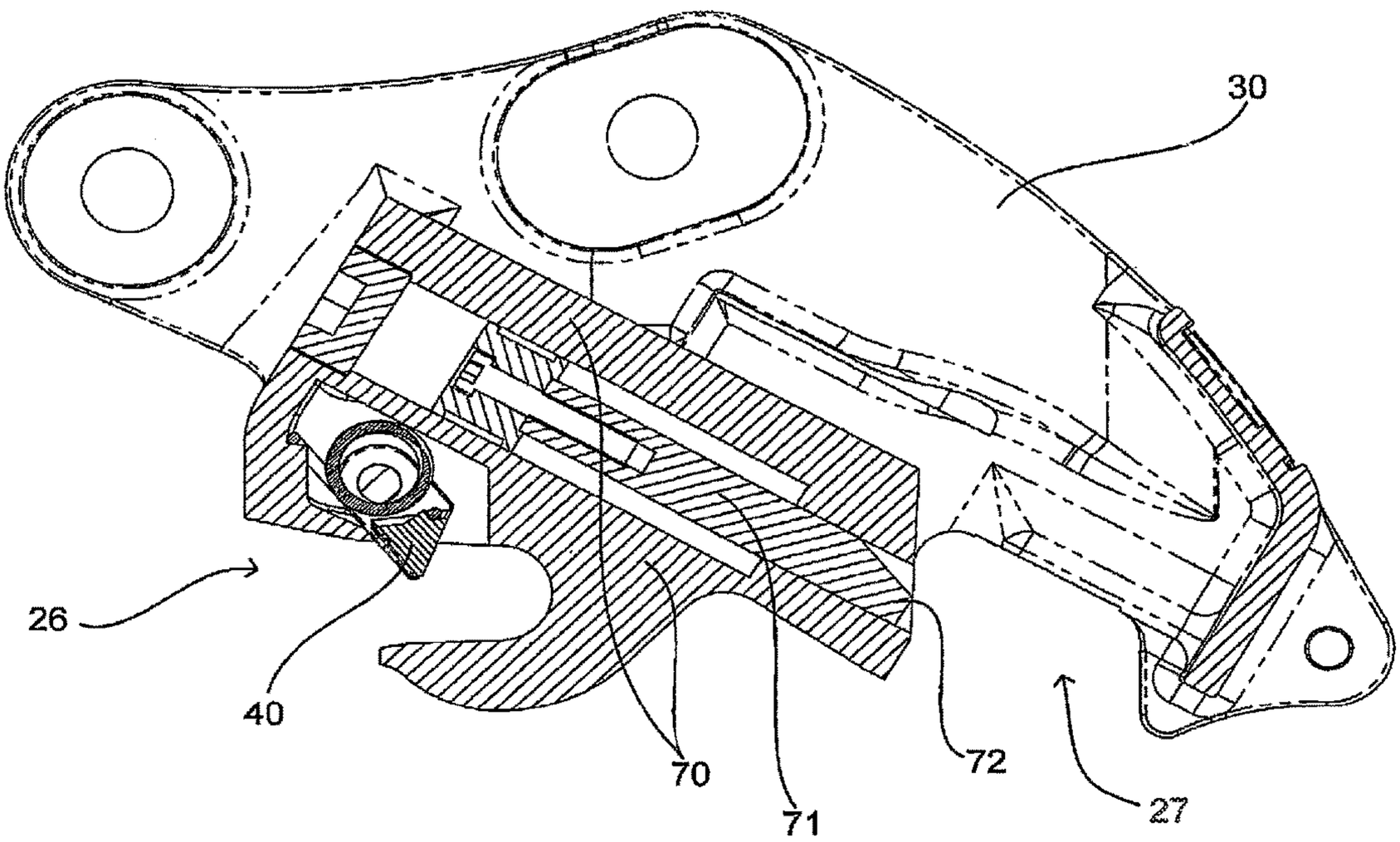

Figure 11

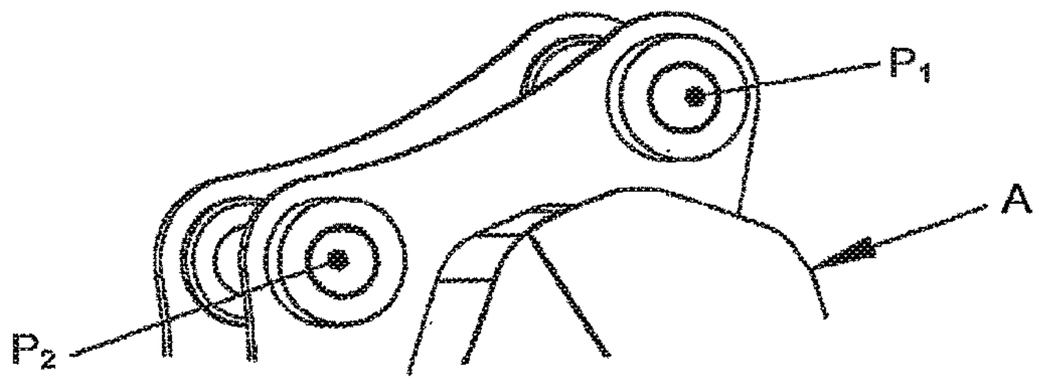

Figure 12

COUPLER FOR EARTH MOVING OR MATERIALS HANDLING MACHINE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of pending U.S. patent application Ser. No. 12/598,018 filed Apr. 20, 2010, which is a National Stage Application of PCT/NZ2009/00030, filed Mar. 6, 2009, which claims benefit of Serial No. 566528, filed Mar. 7, 2008 in New Zealand and which application(s) are incorporated herein by reference. To the extent appropriate, a claim of priority is made to each of the above disclosed applications.

FIELD OF THE INVENTION

The invention relates to couplers for connecting buckets and other implements to earth moving or materials handling machines.

BACKGROUND OF THE INVENTION

Buckets and other implements for earth moving or materials handling machines such as excavators may be formed with a pair of parallel pins for engaging with the arm of the machine. Quick couplers are sometimes used which couple to the parallel pins and also to the arm of the machine.

Quick couplers are thus attached to the machine's arm and allow implements to be easily attached or removed. A quick coupler allows an operator of a machine to attach and remove implements without moving from the cab or operating position of the machine.

In general, couplers include a pair of parallel pins for coupling to the machine's arm. A pair of recesses are formed in the coupler body and are configured to receive the parallel pins of the implement. One or more locking mechanisms lock the received pins into one or both of the recesses.

It is an object of the invention to provide an improved coupler or at least to provide the public with a useful choice.

SUMMARY OF THE INVENTION

In a first broad aspect the invention provides a coupler for coupling an implement to an earth moving or materials handling machine, including:

a coupler body;

a first recess formed in the coupler body and configured to engage with a first pin of an implement;

a second recess formed in the coupler body and configured to engage with a second pin of an implement;

a locking member configured to extend to lock a second pin of an implement into the second recess and to retract to allow movement of a second pin of an implement into or out of the second recess; and

a hydraulic cylinder body and shaft for extending or retracting the locking member, wherein the hydraulic cylinder body is formed integrally with one of the coupler body and the locking member.

Preferably the shaft is connected at one end to the other of the coupler body and the locking member.

Preferably the first pin is a front pin, the first recess is a front recess, the second pin is a rear pin and the second recess is a rear recess.

Preferably the rear and front recesses are positioned and dimensioned to engage with front and rear pins of implements over a range of front and rear pin diameters and/or spacings.

Preferably the pin spacing is in the range 100 mm to 400 mm

Preferably the pin diameter is in the range 30 mm to 60 mm.

Preferably the coupler is configured for attachment to an earth moving or materials handling machine having a weight less than 7,500 kg, more preferably in the range 700 to 7,500 kg.

Preferably the hydraulic cylinder body is formed integrally with the locking member. Preferably the cylinder body and locking member are cast as a single piece. Preferably the cylinder body and locking member are investment cast.

Preferably the coupler body is formed as a single piece. Preferably the coupler body is cast as a single piece.

Alternatively the hydraulic cylinder body is formed integrally with the coupler body. In this case the cylinder body and coupler body are preferably cast as a single piece. Also, in this case, the locking member will be separate from the hydraulic cylinder body.

Preferably the coupler includes a second locking member for locking a front pin of an implement into the front recess.

Preferably the coupler is a quick coupler.

Preferably the machine is an excavator.

In a second broad aspect, the invention provides a method of fabricating a coupler for coupling an implement to an earth moving or materials handling machine, the method including:

forming a hydraulic cylinder body integrally with either a body of the coupler or a locking member for locking a pin of an implement into a recess in the coupler body.

In a third broad aspect the invention provides a coupler for coupling an implement to an earth moving or materials handling machine, including:

a coupler body;

a first recess formed in the coupler body and configured to engage with a first pin of an implement;

a second recess formed in the coupler body and configured to engage with a second pin of an implement;

a locking member configured to extend to lock a second pin of an implement into the second recess and to retract to allow movement of a second pin of an implement into or out of the second recess; and

a hydraulic cylinder body and shaft for extending or retracting the locking member, wherein the locking member extends from the hydraulic cylinder body.

Preferably the shaft is connected at one end to the coupler body.

Preferably the first pin is a front pin, the first recess is a front recess, the second pin is a rear pin and the second recess is a rear recess.

Preferably the rear and front recesses are positioned and dimensioned to engage with front and rear pins of implements over a range of front and rear pin diameters and/or spacings.

Preferably the pin spacing is in the range 100 mm to 400 mm.

Preferably the pin diameter is in the range 30 mm to 60 mm.

Preferably the coupler is configured for attachment to an earth moving or materials handling machine having a weight less than 7,500 kg, more preferably in the range 700 to 7,500 kg.

Preferably the hydraulic cylinder body is formed integrally with the locking member. Preferably the cylinder body and locking member are manufactured as a single piece.

Preferably the coupler body is cast as a single piece.

Preferably the coupler includes a second locking member for locking a front pin of an implement into the front recess.

Preferably the coupler is a quick coupler.

Preferably the machine is an excavator.

In this specification, the term "hydraulic cylinder body" means the body in which the piston rides.

Earth moving or materials handling machines can be adapted for and/or used in various applications including construction, earthworks, demolition, forestry, drainage, quarrying, mining etc. The term "earth moving or materials handling machine" includes machines used in these and other applications. In particular, earth moving and materials handling machines include excavators and telehandlers.

The foregoing and other objectives, features, and advantages of the invention will be more readily understood upon consideration of the following detailed description of the invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL DRAWINGS

The invention will now be described by way of example only, with reference to the accompanying drawings, in which:

FIGS. **1** to **5** are perspective views from different angles of a coupler according to one embodiment.

FIG. **6** is an exploded view of the coupler of FIGS. **1** to **5**;

FIG. **7** is a cross-section through the coupler of FIGS. **1** to **5**;

FIG. **8** is a second cross-section through the coupler of FIGS. **1** to **5**;

FIG. **9** is a side view of a coupler;

FIG. **10** is an end view of a coupler;

FIG. **11** is a cross-section through a coupler according to a further embodiment; and

FIG. **12** shows a top section of an implement

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

FIGS. **1** to **5** are perspective views of one embodiment of coupler **20**, more specifically a quick coupler. The coupler **20** includes an upper section **21** configured to attach to an earth moving or materials handling machine, for example to the arm of an excavator.

As shown most clearly in FIGS. **2** and **3**, the upper section **21** includes a pair of pins **23**, **24** for attachment to an earth moving or materials handling machine. The diameter and centre to centre spacing of the pins **23**, **24** may be designed to suit any particular earth moving or materials handling machine.

The coupler **20** also includes a lower section **25** configured to attach to an implement.

Suitable implements include buckets, tilt buckets, rippers, ploughs, rakes, spades, rollers or any other implements for attachment to earth moving or materials handling machines. Each implement includes a first, front pin and a second, rear pin. The diameter of the pins and spacing between the pins varies across different makes of implement. FIG. **12** shows the top section of an implement A, including a front pin P_1 and a rear pin P_2.

The lower section **25** includes a first, front recess **26** which is configured to receive an implement's front pin. The front recess **26** may include a suitable locking mechanism **26**A (FIG. **5**). For example, a locking mechanism such as disclosed in Wedgelock Equipment Limited's NZ App. No. 546893/552294 may be used.

The lower section **25** also includes a second, rear recess **27** which is configured to receive an implement's rear pin. A locking mechanism (described below) locks the rear pin into this rear recess, such that the shape of the front recess **26** together with the locked rear pin securely attach the implement to the coupler **20**.

FIG. **6** is an exploded view of the coupler **20**. The coupler **20** includes a coupler body **30** which may be formed as a single integral piece. The coupler body may be cast by any suitable casting process, including: sand casting or investment casting. Some machining of the coupler body following casting may be required, such as boring and threading of holes etc.

The pins **23**, **24** pass through bores **31**, **32**, **33**, **34** formed in the coupler body **30**. Each pin **23**, **24** may be formed with a flange **35** which can be secured to the coupler body using fasteners **36** which engage with holes **37** in the coupler body **30**. This both secures the pins **23**, **24** in position and prevents rotation of the pins **23**, **24** relative to the coupler body **30**.

FIG. **6** also shows one embodiment of locking mechanism **26**A for locking an implement's front pin into the front recess **26**. This mechanism is described in detail in NZ App. No. 546893/552294 and will be described only briefly below.

The locking mechanism **26**A includes a locking member **40** which rotates about an axle **41** located in a bore **42** in the coupler body **30**. The axle **41** is kept in position by retaining rings **43**.

A coil spring **44** biases the locking member **40** into a locked position. A linear actuator **45** (such as a hydraulic ram) moves the locking member **40** into an unlocked position when required.

The locking mechanism **26**A shown differs slightly from that disclosed in NZ App. No. 546893/552294. In NZ App. No. 546893/552294 the hydraulic ram drives a lug (marked 30 in NZ App. No. 546893/552294) which is fixed to the locking member. For reduced size and number of parts and for simplicity, in the coupler of FIG. **6** the linear actuator **45** drives the locking member **40** directly, via the engagement portion **46** of the locking member **40**.

A second locking mechanism **50** is configured to lock an implement's rear pin into the rear recess **27** of the coupler body **30**.

This locking mechanism **50** includes a locking member **51** which may be wedge shaped, as shown. The locking member **51** is preferably formed integrally with a hydraulic cylinder body **52**. That is, the locking member and the hydraulic cylinder body may be formed as a single piece. The locking member **51** and hydraulic cylinder body **52** may be formed by any suitable casting process, such as investment casting.

Investment casting provides a high quality and accurate finish, making it particularly suitable for forming the bore of the hydraulic cylinder body **52**.

The locking mechanism **50** thus extends from the hydraulic cylinder body **52**.

A shaft is connected to a piston within the hydraulic cylinder body and the head **53** of the shaft may be shaped to reside within a slot **54** in the coupler body **30**, as is clear from FIGS. **3** to **5**. Thus the shaft of the hydraulic cylinder is fixed with respect to the coupler body **30** while the integral cylinder body **52** and locking member **51** slides with respect to the shaft and the coupler body to lock an implement's rear pin into the rear recess **27**.

The integral cylinder body **52** and locking member **51** is connected to the coupler body by attachment arrangement **55**, which includes a cover plate **56** configured for attachment to the coupler body **30** using a number of fasteners **57**.

The attachment arrangement **55** may also include a contact plate **58** which sits in a recess (not visible in FIG. **6** but shown in FIG. **7**) on the underside of the cover plate **56**. The contact. plate **58** may be formed from a suitable material (such as polytetrafluoroethylene (PTFE)) to reduce friction between the sliding cylinder body **52** and locking member **51** and the stationary contact plate **58** and cover plate **56**.

PTFE strips may also be provided between the lower surface **59** of the integral cylinder body **52** and locking member **51** and the coupler body **30**, again in order to reduce friction.

The cylinder body **52** is formed with a pair of hydraulic ports **60** for feeding hydraulic fluid into or out of the cylinder, in a manner that will be easily understood by the skilled reader.

FIG. **7** is a cross-section through the coupler **20**. This view shows the integral cylinder body **52** and locking member **51** in a retracted position. In this position, an implement's rear pin is able to move freely into or out of the rear recess **27**.

This cross-section also clearly shows the positions of the cover plate **56** and contact plate **58** with respect to the cylinder body **52**.

In the position shown in FIG. **7**, the coupler mounted on an earth moving or materials handling machine can be manipulated such that the front recess **26** engages with an implement's front pin. The locking mechanism **26**A (FIG. **6**) may be such that the locking member freely allows the pin to enter the recess, rotating up into the body of the coupler **20** before returning the locking member **40** to the protruding position shown. Thus, motion of the pin into the front recess is allowed, but motion out of the recess is prevented by the locking member **40**.

The coupler may then be manipulated such that the rear recess **27** engages with the implement's rear pin. When the pin is correctly positioned, a hydraulic actuator drives movement of the hydraulic cylinder body **52** with respect to the hydraulic shaft & piston assembly **61**, from the position shown in FIG. **7** to the position shown in FIG. **8**.

In FIG. **8** the locking member **51** and cylinder body **52** have extended, such that the locking member **51** extends into the rear recess **27** and locks the rear pin **62** of an implement into the rear recess. FIG. **8** also shows the position of the front pin **63** of the implement in the front recess **26**.

FIGS. **9** and **10** show one particular embodiment, in which the coupler is suitable for use with mini earth moving or materials handling machines. Mini earth moving or materials handling machines have a weight in the range 700 to 7500 kg. The dimensional data given below is given solely for the purpose of describing one embodiment of the invention and is not to be regarded as limiting the scope of protection sought.

This coupler may have a length L (FIG. **9**) of around 524 mm. The coupler may be configured to couple to implements having minimum and maximum pin spacings of 180 and 220 mm respectively. The minimum and maximum pin spacings for a particular configuration are indicated by the dimensions S and S' in FIG. **9**.

The coupler may be configured to couple to a range of pin sizes. In particular, the implement's pins **62**, **63** as an example may be between 35 mm and 40 mm in diameter. Alternative configurations could accommodate other combinations of pin diameters such as 40 mm and 45 mm etc.

The height H between the front pin **23** connecting the coupler to an earth moving or materials handling machine and the centre of the front recess **26** may be around 170 mm. The front recess **26** may be offset by a distance O behind the front pin **23**. The distance O may be around 140 mm.

As shown in FIG. **10**, the coupler may have a width W at the top of the coupler around 210 mm. The width W' between the inside walls of the coupler may be between 122 and 147 mm. The overall height H' of the coupler may be around 308 mm. The width W" at the bottom of the coupler may be around 121 mm.

In general, dimensions of couplers may vary depending on the size or type of earth moving or materials handling machine for which the coupler is designed.

FIG. **11** shows an alternative embodiment, in which the cylinder body **70** is formed integrally with the coupler body **30**, again by casting (including investment casting) or any other suitable process for forming the integral coupler body and cylinder body as a single piece. In this embodiment, the end of the hydraulic shaft **71** is connected to or formed integrally with the locking member **72**.

Forming the cylinder body integrally with either the coupler body or the locking member reduces the number of parts in the coupler. This coupler is particularly suited to smaller earth moving or materials handling machines. With these machines the size of the coupler is limited and incorporating the hydraulic cylinder body into either the locking member or the coupler body enables the various components to be more easily contained in a smaller coupler. This is especially true of couplers suitable for a range of implements, since a greater range of displacement of the locking mechanism is required to accommodate a range of pin spacings and/or diameters, so that a long-stroke cylinder must be used.

The coupler is particularly suited to earth moving or materials handling machines having a weight less than 7,500 kg, particularly machines having a weight in the range 700 to 7,500 kg. However, the coupler may be used with earth moving or materials handling machines of any size.

The coupler body may be formed as a single piece. This eliminates many machining steps, making the coupler simpler and less costly to produce.

The coupler is configured to couple to a range of implements from different suppliers. These implements will have different pin diameters and pin spacings, but the coupler allows a range of implements to be used with a single coupler. For example, the coupler may accommodate pin spacings in the range 100 to 400 mm and pin diameters in the range 30 to 60 mm.

While the present invention has been illustrated by the description of the embodiments thereof, and while the embodiments have been described in detail, it is not the intention of the Applicant to restrict or in any way limit the scope of the invention to such detail. Additional advantages and modifications will readily appear to those skilled in the art. Therefore, the invention in its broader aspects is not limited to the specific details, representative apparatus and methods, and illustrative examples shown and described. Accordingly, departures may be made from such details without departure from the spirit or scope of the Applicant's general inventive concept.

The terms and expressions which have been employed in the foregoing specification are used therein as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding equivalents of the features shown and described or portions thereof,

it being recognized that the scope of the invention is defined and limited only by the claims which follow.

What is claimed is:

1. A coupler for coupling an earth-moving or materials-handling machine to an attachment having at least one attachment pin, the coupler having a first interface for securely engaging the machine and a second interface for securely engaging the attachment, the second interface comprising a recess exterior to the coupler for receiving a respective said at least one attachment pin, the coupler comprising:

a coupler body defining a cavity; and

a locking member housed at least partially in the cavity, the locking member comprising a fluid-receiving cylinder body and a shaft slidable relative to the cylinder body in response to fluid pressure in the cylinder body, the shaft fixed relative to the coupler body and the cylinder body defining a wedge extendably slidable into and out of the recess of the second interface so as to selectively, alternately engage and disengage a respective said at least one attachment pin.

2. The coupler of claim **1** where the second interface comprises a first recess for receiving a first attachment pin and a second recess for receiving a second attachment pin.

3. The coupler of claim **2** where the wedge is extendably slidable into and out of the first recess.

4. The coupler of claim **1** where the fluid receiving cylinder body is constrained to slide in the coupler body on a surface defined by the coupler body.

5. The coupler of claim **1** where the shaft slides outward from the cylinder body when the wedge slides inward into the recess.

6. The coupler of claim **5** where the shaft slides inward into from the cylinder body when the wedge slides outward from the recess.

7. The coupler of claim **1** where the cylinder body and wedge are integrally formed with each other as a single member.

8. The coupler of claim **7** where the single member is cast.

9. The coupler of claim **8** where the single member is investment cast.

* * * * *